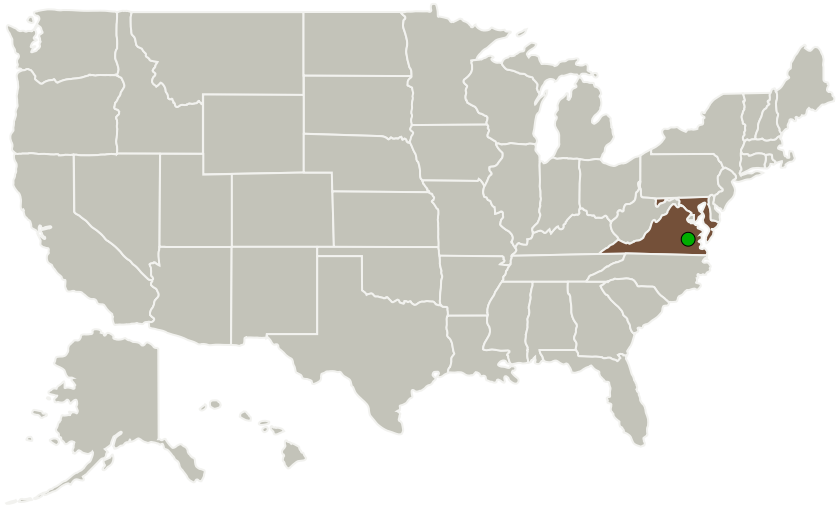
A Modular Swarm Optimization Framework Enabling Multi-Vehicle Coordinated Path Planning, Phase I

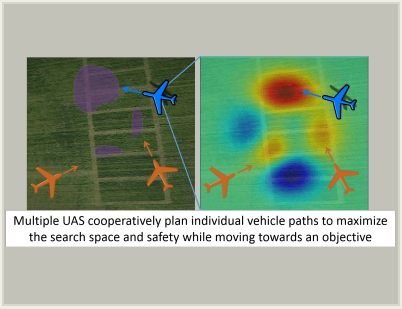
Completed Technology Project (2015 - 2015)

Project Introduction

The advancement of Unmanned Aerial Systems (UAS) with computing power and communications hardware has enabled an increased capability set for multi-vehicle collaborative operations. By cooperatively allocating unmanned resources, vehicle tasking, and planning the subsequent vehicle paths, the efficiency of UAS operations can be maximized. Heron Systems proposes the Multi-Agent Cooperative Engagement (MACE) framework that enables collaborative resource allocation, task allocation, and path planning for unmanned systems operating in dynamic environments subject to diverse communication conditions. This Phase 1 work will focus on the path planning portion of MACE, as path planning is an integral part of collaborative efforts in nearly every real world application. The path planning architecture will define key modules to plan paths to a global objective, assess potential obstacles, and avoid collisions while maintaining progress towards the global objective. The framework will be constructed in a modular fashion to allow a plug-and-play capability for the resource/task allocation as well as the various components of the path planning pipeline, giving end users the flexibility to explore other methods for UAS collaboration. At the conclusion of Phase 1, the MACE path planning capability will be demonstrated using Heron Systems' previously developed flexible UAS simulation suite and ISAAC software, promoting high fidelity hardware-in-the-loop simulation/stimulation testing with COTS hardware components.

Primary U.S. Work Locations and Key Partners





Multiple UAS cooperatively plan individual vehicle paths to maximize the search space and safety while moving towards an objective

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Organizations Performing Work	Role	Type	Location
Heron Systems, Inc.	Lead Organization	Industry Small Disadvantaged Business (SDB)	California, Maryland
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations	
Maryland	Virginia

Project Transitions

June 2015: Project Start

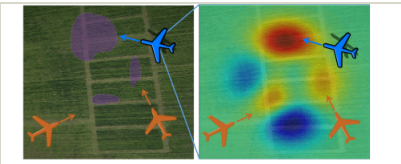
December 2015: Closed out

Closeout Summary: A Modular Swarm Optimization Framework Enabling Multi-Vehicle Coordinated Path Planning, Phase I Project Image

Closeout Documentation:

- Final Summary Chart Image*(https://techport.nasa.gov/file/138625)*

Images



Briefing Chart Image
A Modular Swarm Optimization Framework Enabling Multi-Vehicle Coordinated Path Planning, Phase I *(https://techport.nasa.gov/image/135057)*

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Heron Systems, Inc.

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

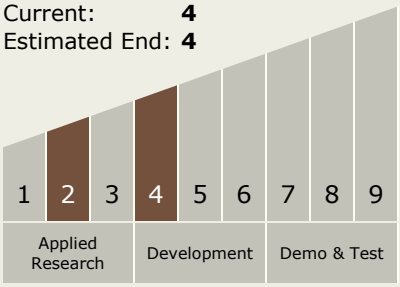
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Kenneth Kroeger

Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**



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Technology Areas

Primary:

- TX10 Autonomous Systems
  - TX10.1 Situational and Self Awareness
    - TX10.1.1 Sensing and Perception for Autonomous Systems

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System